

State of Wisconsin Department of Transportation

Facilities Development Manual

TABLE OF CONTENTS

Chapter 11	Design
------------	--------

	Procedure Number
SECTION 1 - INTRODUCTION	
Subject 1 – Application of Standards	11-1-1
Subject 2 – Exceptions to Standards	11-1-2
Subject 3 – Metrics and Design	11-1-3
Subject 4 – Programmatic Exception to Standards	11-1-4
SECTION 3 - COMMUNITY SENSITIVE DESIGN	
Subject 1 – Policy & Principles	11-3-1
Subject 5 – Decision Making Guidance	11-3-5
SECTION 5 – GENERAL DESIGN CONSIDERATIONS	
Subject 1 – Scope of Construction Projects	11-5-1
Subject 3 – Highway Capacity	11-5-3
Subject 5 - Access Control	11-5-5
Subject 10 - Earthwork	11-5-10
Subject 15 – Select Materials in Subgrades	11-5-15
SECTION 10 - DESIGN CONTROLS	
Subject I - Basic Criteria	11-10-1
Subject 5 - Geometric Elements	11-10-5
SECTION 15 - CROSS-SECTION ELEMENTS FOR RURAL HIGHWAYS	AND FREEWAYS
Subject 1 - Dimensions and Design Classes	11-15-1
Subject 5 - Design Criteria for the Great River Road	11-15-5
Subject 10 – Passing Lanes and Climbing Lanes	11-15-10
SECTION 20 - CROSS-SECTION ELEMENTS FOR URBAN HWYS. &	STREETS
Subject 1 - Dimensions and Design Classes	11-20-1
Subject 5 - One-Way Streets	11-20-5
Subject 10 - Driveways	11-20-10
SECTION 25 - INTERSECTIONS AT GRADE	
Subject 1 - General	11-25-1
Subject 5 - Left-Turn Lanes	11-25-5
Subject 10 - Right-Turn Lanes	11-25-10
Subject 15 - Turning Roadways (Channelized Right Turns)	11-25-15
Subject 20 - Median Openings	11-25-20
Subject 25 - Channelization	11-25-25
Subject 30 - Curb Ramps	11-25-30
Subject 35 - Auxiliary Lanes	11-25-35
Subject 40 - Railroad Crossings	11-25-40
Subject 45 - Frontage Roads	11-25-45

Date April 23, 2004 Page 1

	Procedure Number
SECTION 26 – ROUNDABOUTS	
Subject 1 – General	11-26-1
Subject 5 - Project Scoping & Feasibility	11-26-5
Subject 10 – Preliminary Design	11-26-10
Subject 15 – Final Design	11-26-15
SECTION 30 - INTERCHANGES	
Subject 1 - Design Elements	11-30-1
Subject 5 - Cross Section - Ramp and Crossroad	11-30-5
Subject 10 - Collector Distributor Roads	11-30-10
SECTION 35 - STRUCTURES	
Subject 1 - Widths, Clearances, Sidewalks & Protective Screening	11-35-1
Subject 5 - Temporary Bridges	11-35-5
Subject 10- Three Lane Bridge Criteria	11-35-10
SECTION 40 - RESURFACING, RESTORATION, AND REHABILITATION	N PROJECTS
Subject 1 - Design Criteria for Highways Other Than	
Freeways and Expressways	11-40-1
Subject 2 - Design Criteria for Resurfacing Expressways	
and Freeways (Non-Interstate)	11-40-2
SECTION 44 - INTERSTATE HIGHWAYS	
Subject 1 – 4R Projects	11-44-1
SECTION 45 - OTHER ELEMENTS AFFECTING GEOMETRIC DESIG	
	11-45-1
Subject I - Traffic Barriers and Crash Cushions	11-45-5
Subject 5 - Fencing	
Subject 10- Bicycle Facilities	11-45-10
SECTION 50 - TRAFFIC CONTROL	
Subject 1 - Pavement Marking	11-50-1
Subject 5 - Signals	11-50-5
Subject 10 - Signing	11-50-10
Subject 15 - Lighting	11-50-15
Subject 20 – Safety in Work Zones	11-50-20
Subject 21 - Work Zone Traffic Control Plan Process	11-50-21
Subject 22- Work Zone Traffic Congestion and Mitigation	11-50-22
Subject 25 - Detours/Construction Under Traffic	11-50-25
Subject 30 - Law Enforcement in Work Zones	11-50-30
SECTION 55 - SPECIAL FEATURES	44.55.4
Subject 1 - Boat Ramps	11-55-1
Subject 3 - Timber Management	11-55-3
Subject 5 - Retaining Walls	11-55-5
Subject 10 - Cattle Pass Design	11-55-10
Subject 15 - Permanent Public Trails Crossing Rural Public Roads	11-55-15
Subject 20 - Overhead Sign Supports	11-55-20
SECTION 60 - DETOURS	44.00.4
Subject 1 - General	11-60-1
Subject 5 - Interim Liquidated Damages	11-60-5

Date June 29, 2006 Page 2

List of Figures

Procedure	Figure	Title
11-1-4	1	Programmatic Exception to Standards Report
	2	Safety Screening Analysis and Accelerated Design Flow Charts
	3	Glossary of Items
	4	Sample Metamanager Safety Spreadsheet
	5	Improvement Flag Problem Descriptions
	6	Safety Screening Worksheet
	7	Crash Report Analysis Worksheet
	8	Suggested Step 3 Process
11-3-5	1	CSD Considerations for Horizontal Alignment
1100	2	CSD Considerations for Vertical Alignment
	3	CSD Considerations for Stopping Sight Distance
	4	CSD Considerations for Intersection Sight Distance
	5	CSD Considerations for Passing Sight Distance
	6	CSD Considerations for Decision Sight Distance
	7	CSD Considerations for Cross Section (Lane)
	8	CSD Considerations for Cross Section (Earle) CSD Considerations for Cross Section (Shoulder)
	9	CSD Considerations for Cross Section (Shoulder) CSD Considerations for Cross Section (Medians)
	10	CSD Considerations for Cross Section (Roadside)
	11	CSD Considerations for Intersections
	12	CSD Considerations for Access Control
	13	CSD Considerations for Pedestrian/Bicycle Accommodations
	14	CSD Considerations for Bridges
11-5-5	1	Access Spacing Guidelines
	2	Access Control for Typical Interchange
11-5-10	1	Compaction of Soils
	2	Bridge Approach Construction Techniques
11-5-15	1	Areas for Inclusion of Select Materials
	2	Standard Select Materials Systems
	3	Typical Half Section With Select Materials
	4	Typical Half Section With Select Materials, 4-Lane Divided Highway, 50 ft
		Median Birit Mill O I
	5	Typical Half Section With Select Materials, 4-Lane Divided Highway, 60 ft Median
	6	Median Drain Detail for Select Materials Layer Greater Than c _{max}
	7	Typical Section for 1-Lane Ramp With Select Materials
11-10-5	1	Sight Distance Criteria
	2	Maximum Grades by Functional Classification
	3,3M	Stopping Sight Distance for Crest Vertical Curves
	4,4M	Stopping Sight Distance for Sag Vertical Curves
	5	Passing Sight Distance for Crest Vertical Curves
	6,6M	Sight Distance on Horizontal Curves
	7	Profile and Cross Sections of Two-Lane Highway to the Right
	8	Profile and Cross Sections of Two-Lane Highway Curve to Right
	9,9M	Superelevation Tables (e _{max} = 4% and 6%)
	10	Superelevation Tables (e _{max} – 4% and 6%) Superelevation Design Charts
	11	Guide Dimensions for Vision Triangles, Stop Control on Minor Road
	12	
		Example of Vision Corner
	13	Clear Sight Window
	14	On-Street Parking Limits
	15	Sample Problem – Intersection Sight Distance
	16	Left-Turn Lane Offset

Procedure	Figure	Title
11-15-1	1,1M	Design Criteria for Rural State Trunk Highways Functionally Classified as
	0.014	Arterials
	2,2M	Design Criteria for Rural State Trunk Highways Functionally Classified as Collectors
	3,3M	Design Criteria for Rural State Trunk Highways Functionally Classified as
	3,3101	Local Roads
	4	Minimum Design Standards for Town Roads (New Construction Only)
	5	Rural State Trunk Highway Paved Shoulder Width Requirements
	6	Typical Cross Sections for Rural 2-Lane Highways
	7	Typical Cross Sections for Divided Highways and 1-Lane Ramps
	8	Roadway Sections in Rock Cut
	9,9M	Clear Zone Width Criteria
	10,10M	Clear Zone Distance Tables & Recovery Area Width Determination
	11	Horizontal Curve Correction Factor
	12	Ditch Traverseability Evaluation Charts
	13	Typical 2- to 4-Lane Transition
	14	Typical Marsh Sections
	15	Typical Driveway Cross Section and Profiles
	16	Lateral Clearance on Rural Roadway
	17	Design Criteria for County Trunk Highways Functionally Classified as
		Arterials
	18	Design Criteria for County Trunk Highways Functionally Classified as Collectors
	19	Design Criteria for County Trunk Highways Functionally Classified as Local Roads
11-15-5	1	Great River Road Map
11-15-10	1	Rural STH Passing Lane Corridors
	2	Warrant for Considering Passing Lanes
11-20-1	1,1M	Urban Streets Rdwy Criteria for Posted Speed Limits of 40 mph or less
	2	Typical Street Cross Sections, Classes 1b, 2a, 2b & 3
	3	Typical Street Cross Sections, Class 4 and Class 5
	4	Factors Used for Highway Capacity Manual LOS Thresholds
	5, 5M	Transitional and High-Speed Urban Roadway Criteria for Posted Speed
		Limits of 45 – 55 mph
	6	Typical Transitional / High-Speed Urban Street Cross Sections
	7	Required Lateral Clearance
11-20-10	1	Urban Driveway Details
11-25-1	1	Selection Criteria for Rural Intersections
	2	Taper Length Criteria
	3	Physical and Functional Areas of an Intersection
	4	Elements of Upstream Functional Intersection Area
11-25-5	1	Urban Median Opening and Intersection Guidelines
	2	Median Openings and Left Turn Lanes in Urban Roadways
	3	Details for Intersections and Median Openings at Urban Intersections
	4	Median Opening With Left Turn Lane on Rural Expressways
	5	Left-Turn Island/Median Offsets
11-25-30	1	Pedestrian Consideration Guidelines
11-25-45	1	Frontage Road Offset Guidelines
11-26-1	1	Traffic Flow Worksheet
	2	Roundabout Features
	3	Roundabout Design Parameters
	4	Design Parameters vs. Capacity

Procedure	Figure	Title
11-26-10	1	Path Overlap
	2	Techniques to Avoid Path Overlap
	3	Proper Multi-lane Entry Design
	4	Approach Offset
	5	Capacity vs. Inscribed Circle Diameter
11-26-15	1	Sample Signing Plan for an Urban Roundabout
	2	Sample Signing Plan for a Rural Roundabout
	3	Lane Marking at Multi-lane Entrance
	4	Direction Arrow Marking at Multi-lane Entrance
	5	Double Left Turn Markings at a Conventional Intersection
	6	Double Left Turn Marking for a Roundabout
	7	Typical Roundabout Pavement Marking
	8-11	Examples of Pavement Marking for Different Roundabout Configurations
11-30-1	1	Single Lane Entrance Terminal
	2	Single Lane Exit Terminal
	3	Typical Entrance and Exit Ramp Terminal Details
	4	Typical Details of Ramp - Mainline Intersections
44.05.4	5	Details of Ramp - Mainline Intersections with Special Turn Lanes
11-35-1	1	Structure Roadway Width and Approach Details
	2	4 - Lane Divided Highway Structure Widths (w/Acceleration Lanes)
	3	4 - Lane Divided Highway Structure Widths (w/Deceleration Lanes)
	<u>4</u> 5	2, 4, and 6 - Lane Structure Widths (Special Situations)
		Lateral Clearances for Urban Expressways and Freeways Beneath Structures
	6	Lateral Clearances for Streets Beneath Structures
	7	Lateral Clearances at Bridge Underpass for Rural Highways
	8	Minimum Vertical Clearance for New Bridges and Replacement Bridges
	9	Minimum Vertical Clearance for Bridges to Remain
11-35-5	1	Span vs Superstructure Depth
11-40-1	1	Alternatives to Reconstruction to Enhance Safety
	2	3R Design Criteria for Rural State Trunk Highways Functionally Classified as Arterials
	3	3R Design Criteria for Rural State Trunk Highways Functionally Classified as Collectors and Locals
	4	Design Criteria for Resurfacing/Reconditioning Town Roads
	5	Design Criteria for 3R Projects on Rural County Trunk Highways Functionally Classified as Arterials
	6	Design Criteria for 3R Projects on Rural County Trunk Highways Functionally Classified as Collectors and Locals
	7	Evaluation of an Existing Horizontal Curve
11-45-1	1	Freeway Median Barrier Warrants for New Construction
11 -4 5-1	2	Beam Guard as Side Road
	3	Beam Guard Terminal Earthwork
	4	Adjacent Side Hazard Barrier
	5	
	6	Opposite Side Hazard Barrier
	7	Length of Need Graphical Solution
		Length of Need, Method 2: Encroachment Angle
	8	Beam Guard End Treatment (EAT)
	9	Beam Guard End Treatment (Anchorage)

Procedure	Figure	Title
11-45-1 cont.	10	Length of Need Beyond Hazard for Divided Roadways
	11	Impact Attenuator Array
	12	QuadGuard LMC System
	13	REACT-350 System
	14	QuadGuard System w/Concrete Backup
	15	QuadGuard System w/Tension Strut Backup
	16	QuadGuard System w/69" & 90" Tension Strut Backup
	17	QuadGuard System w/69" & 90" Concrete Backups
11-45-10	1	Bikeway - Railroad Crossing Detail
	2	Bike Lane on Curbed Street
	3	Combined Bike Lane and Parking Lane
	4	Bike Path Design
	5	Bicycle Accommodation on Highway Structures
11-50-1	1	Pavement Marking Material Decision Process
11-50-20	1	Traffic Safety in Highway and Street Work Zones
	2	Policy for the Use of Type "C" Steady-Burn Lights on Traffic Control
		Drums
	3	Work Zone Traffic Control Plan Review Checklist
11-50-21	1	Work Zone Traffic Control Plan Process
11-50-30	1	Policy on the Use of Extraordinary Enforcement Efforts in Construction
		Zones
	2	Format for Agreements with the Division of State Patrol
11-55-1	1	Boat Ramp Details
	2	Pier Details
	3	Boat Ramp Example Parking Layouts
	4	Boat Ramp Example Parking Layouts
11-55-10	1	Documentation for Cattle Pass
11-55-15	1	Grade Separation Warrants
	2	Grade Separation Warrant Worksheet
	3	Sample Grade Separation Warrant Determination
	4	Sight Distance for Trail Crossing
11-55-20	1	Sign Support Base Design Process
11-60-5	1	Sample Calculation of Average Car Operating Cost
	2	Sample Calculation of Interim Liquidated Damages